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Your attention is invited

**NEWS
OF THE
SANITARY
ENGINEERING
DIVISION
OF
ASCE**



**JOURNAL OF THE SANITARY ENGINEERING DIVISION
PROCEEDINGS OF THE AMERICAN SOCIETY OF CIVIL ENGINEERS**



DIVISION ACTIVITIES

SANITARY ENGINEERING DIVISION

Proceedings of the American Society of Civil Engineers

NEWS

July, 1961

PIPELINE DIVISION COMMITTEE ACTIVITY

During 1956, at the Pittsburgh Convention, the Pipeline Division was officially organized as the newest of the technical divisions. Within the Pipeline Division are several technical committees providing a variety of areas of interest in pipelining. One of these committees, the Committee on Pipeline Planning, was organized with the following purposes:

To investigate and correlate studies on pipeline design and economics, to cooperate with existing organizations in the accomplishment of this purpose, and to disseminate this information to the profession.

With this objective, the primary intent both within the Pipeline Division and the Committee on Pipeline Planning is that membership should include civil engineers from the pipeline function of the water, oil, gas and products industries. A review of basic pipeline design concepts for each of these industries points out wide design and operating differences--such things as working pressures, stress levels, fitting design, etc., show very little consistency between the various engineering groups working on the design of pipelines.

At the present time, the bulk of the membership of the Committee on Pipeline Planning is made up of gas and oil industry civil engineers. The control group of the Committee feels that it would be extremely worthwhile if the committee could be enlarged to include hydraulic, waterworks and sanitary engineers who have an interest in the design of pipeline facilities. Major activities of the Committee on Pipeline Planning includes such things as investigation of the problems involved in the regulation of pipeline design and construction, welding of pressure vessel, investigation of economic aspects of mitigating pipeline corrosion and compilation of a bibliography of pipeline design.

The committee would welcome active participation in its activities by hydraulic, waterworks and sanitary engineers. The committee would also welcome suggestions relative to other areas of study and interest that could provide useful information to the pipeline industry. A joint effort between pipe-

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line engineers in the water, oil and gas fields with the objective of correlating some of the many differences in pipeline design concepts could only be achieved by participation of engineers from these areas.

Interested hydraulic, waterworks and sanitary engineers are urged to contact Mr. Francis Stastny, Chairman of the Committee on Pipeline Planning, 3923 Milton Street, Shreveport, Louisiana.

DID YOU KNOW THAT

Peter F. Mattei was appointed Executive Director of the St. Louis Metropolitan Sewer District by the Board of Trustees. Mr. Mattei had been filling the office under an interim appointment since the resignation last year of William Q. Kehr.

Max S. Campbell has been appointed to the Washington State Board of Health, to replace Professor R. O. Sylvester of the University of Washington, who resigned.

Carl A. Rambow, a research engineer with California Research Corporation has accepted an appointment as Assistant Sanitary Engineer in the Sanitary Engineering Section, Division of Industrial Research, Washington State University.

Leland C. Burroughs has joined the American Petroleum Institute as Consultant on Air and Water Pollution. Burroughs will administer the API technical committees concerned with air and water pollution, and will serve as liaison between API and all agencies whose interest in air and water pollution work relates to fields of activity of the petroleum industry.

SANITARY ENGINEERING EDUCATION

ILLINOIS TECH GETS GRANT FOR TRAINING PROFESSORS

Illinois Institute of Technology has been awarded a Ford Foundation grant of \$50,000 to be utilized in a program to encourage highly qualified individuals into faculty careers in engineering, it was recently announced by Dr. John T. Rettaliata, IIT president.

The grant will enable Illinois Tech to make forgivable loans to present or potential doctoral students who wish to enter engineering faculty careers but who have financial needs that prevent them from completing their courses. These loans are meant to meet legitimate personal financial needs that cannot be met by other means already at the institution's disposal.

The loans to be awarded may be granted over a period of three years to any one applicant, but the total loaned to him shall not exceed \$10,000. It will be forgiven at the rate of \$1000 per year for service on an engineering faculty in the United States or Canada. If the recipient does not so serve the loan is repayable at the rate of \$100 per year. Selection among eligible candidates will be based on the degree of likelihood of excellent performance by the applicant both as a doctoral candidate and as a teacher of engineering.

Funds accumulated from interest and repayment will be re-used by IIT under the original terms. If, after five years from the date of the original Ford Foundation grant, IIT authorities deem that it is no longer practical to so use such funds, the remaining portion of the grant may then be expended for any educationally useful purpose.

WATER SUPPLY & POLLUTION CONTROL

67% OF U. S. PULP, PAPER AND PAPERBOARD MILLS HAVE WASTE TREATMENT FACILITIES

According to preliminary data accumulated through the Industrial Water Use Survey, being conducted by the National Council for Stream Improvement in cooperation with the National Association of Manufacturers, 67% of all pulp, paper and paperboard mills have waste treatment facilities. This compares with 39% according to the "Water in Industry" report published by NAM in 1950.

Also, according to the current survey, water intake by the pulp, paper and paperboard industry currently amounts to 4,980,000,000 gallons daily. Discharge amounts to 4,800,000,000 gallons daily with actual consumption amounting to 180,000,000 gallons daily, or slightly over 3% of intake.

Water recirculation makes the intake of 4,980,000,000 gallons do the work of 12,780,000,000 gallons that would be required if no recirculation was practiced. Also, according to the survey, water use, exclusive of cooling water, amounts to 33,700 gallons per ton of average production.

WILBAR ELECTED ORSANCO CHAIRMAN

Dr. C. L. Wilbar, Jr., Pennsylvania State Health Secretary and Sanitary Water Board Chairman, has been elected Chairman of ORSANCO (the Ohio River Valley Water Sanitation Commission).

Dr. Wilbar will succeed Ross H. Walker, member of the Virginia Water Control Board, as ORSANCO head. The election was held at the regular spring meeting of the commission, in Pittsburgh. Dr. Wilbar has served as vice-chairman, and chairman of the finance committee, of ORSANCO.

ST. JOSEPH, MISSOURI, VOTES \$6 MILLION BOND ISSUE

St. Joseph, Missouri, after the Federal Government had brought suit against the City and after two previous bond issues in 1958 and 1960 had failed, passed a \$5,955,000 bond issue in April. The issue was approved by a vote margin of 11 to 4.

This action removes the major remaining barrier in a Federal-State program to clean up the Missouri River and points up the effectiveness of the Federal Enforcement Program in the control of water pollution. Other cities falling under this program include Sioux City, Iowa; Omaha, Nebraska; Kansas City, Kansas, and Kansas City, Missouri. St. Joseph is the only city in the Nation to be subjected to court action under the Federal Water Pollution Control Act (P.L. 660) to date.

The St. Joseph case began nearly four years ago, when a conference disclosed that wastes from the City and 18 industries in the St. Joseph area were causing serious pollution of the river. The industries subsequently agreed to take steps to treat their wastes but the residents of St. Joseph twice refused to do so, voting down one bond issue for this purpose in 1958 and another in 1960. After a public hearing the Federal Government brought suit against the City at the request of the Kansas State Board of Health and with the concurrence of the Missouri Water Pollution Control Board. The case is now on the docket of the U. S. District Court in Kansas City. It was called up on March 9, but the judge postponed the setting of a trial date until after the referendum.

From South Dakota to St. Louis--cities and industries are now operating, building, or preparing to build adequate treatment facilities for their wastes. The completion of this program will mark a forward step in resource management, public health, and conservation in this region.

STATE LEGISLATION IN NEW ENGLAND

The General Court of Massachusetts has enacted Chapter 7 of the Resolves of 1961 authorizing the Water Resources Commission to make an investigation and study relative to State financial aid for the construction of municipal sewage treatment works. Pending is legislation (S.377) exempting any treatment facility constructed for the abatement or prevention of air or water pollution from local taxation.

In Vermont the Department of Water Resources has been created by Executive Order under No. 329 of the Acts of 1959. Within this new State agency is the Vermont Water Resources Board. This new Board and Department have taken the place of the Vermont Water Conservation Board. Pending in Vermont are bills providing for annual inspections of sewage disposal plants by the Water Resources Board; clarifying existing statutes authorizing bonds for sewerage systems by a majority vote; and authorizing additional bonds for State-aid for municipal sewage treatment plants.

PHS AWARDS CONTRACT FOR FOAM FRACTIONATION STUDY

Dr. Luther L. Terry, Surgeon General of the Public Health Service, recently announced award of a \$30,940 contract to Schenley Industries' Research Division, Radiation Applications, Inc., Long Island, New York.

Purpose of the year-long contract is to study development of foam fractionation as a technique for removal of contaminants remaining in sewage treatment plant effluents. In the process of foaming, bubbles of air rising through a liquid containing surface active compounds, such as synthetic detergents, produce a high concentration of the materials at the surface. The foam with the contaminants is then removed.

The Schenley contract is one of a series to be let to universities, industries, and private research organizations as part of the new advanced sewage treatment research program of the Service's Division of Water Supply and Pollution Control. This is in line with the final report of the Senate Select Committee on National Water Resources which recommended expansion of presently known methods and development of new ones "so as to avoid continued pollution of our streams which makes the use of large amounts of water to prevent them from becoming open sewers."

SALINE WATER CONVERSION REPORT FOR 1960 PUBLISHED

The Saline Water Conversion Report for 1960 has been published and is available for public distribution. The report is a nontechnical review of program activities during the past year. It contains a summary of the developments during 1960 of each of the several major process groups on which research and development work was conducted as well as a report of the status of the demonstration plant program.

Copies of the report may be obtained without charge from the Office of Saline Water, United States Department of the Interior, Washington 25, D. C.

SEWAGE RECLAMATION STUDIES FOR UNIVERSITY CITY

University City is a future city of 100,000 population being planned by the Irvine Company of Orange County, California, with a new 1,000-acre campus of the University of California (eventual enrollment of 27,000 students) located as the "hub" of the city. Preliminary engineering studies completed in the month of May indicate it will be feasible to reclaim to entire ultimate sewage flow from this area (approximately 10 mgd) by reclamation for use in irrigating agricultural lands, recreational parks (including a "Green Belt"), golf courses, and the University campus grounds.

Various factors combine to enhance the feasibility of such reclamation. These include the reservation of more than 2,000 acres for agricultural and park purposes through ultimate growth of the city, the fact that the entire area will be developed under a single management (thus simplifying the solution of legal and administrative problems), and the availability in the area of large reservoir capacities which can be used for prolonged oxidation treatment and/or storage. The preliminary plans were developed by Engineering-Science, Inc. in collaboration with the Irvine Company and provide for complete treatment of all effluent to be used for agricultural irrigation, and for additional treatment comprising chemical flocculation, sand filtration, and chlorination for all effluent used for recreational purposes (including maintenance of artificial lakes)

REPORT ON HEAT POLLUTION

Stream temperatures should be regulated, because discharge of hot water to streams "may be against the public interest, and may create difficulty in the future," the Pennsylvania Sanitary Water Board was informed.

A special advisory committee to the Board, representing industry, sportsmen, and federal and state government, presented its report and recommendations to the Board summarizing more than 20 months of detailed stream studies and conferences on problems posed by heated wastes.

The Health Department's environmental health bureau will study the committee's recommendations and then propose specific regulations for controlling stream temperatures for Sanitary Water Board approval.

Dr. C. L. Wilbar, Jr., State Health Secretary and Sanitary Water Board Chairman, said that the effect of the committee's recommendations, if adopted, would be to require industries to keep their discharges from raising the total stream temperature at point of discharge to more than 93 degrees.

"Protection of aquatic life is the principal objective of regulating stream temperatures," the committee reported, adding that "there is no evidence that discharge of hot water to Pennsylvania streams has created a problem up to this time except in isolated and infrequent cases. However, such discharges may create difficulty in the future."

"Fish kills occur from time to time, from a variety of causes, some of them natural, but it is uncommon for fish to be killed directly by hot water," the report pointed out.

FIRM SELECTED TO DESIGN N. C. SALINE WATER CONVERSION DEMONSTRATION PLANT

The Lummus Company of New York City has been selected for the architect-engineer assignment for the east coast saline water conversion plant which is to be erected at Wrightsville Beach, North Carolina. The contract negotiated with the Lummus Company is a cost-reimbursable fixed-fee contract not to exceed \$99,800. The Lummus Company will evaluate existing saline water conversion freezing processes, prepare performance specifications, and provide assistance during the construction of the plant.

The Wrightsville Beach plant is one of five such installations authorized under Public Law 85-883. It will demonstrate a freezing process and will be designed to convert sea water to fresh water at an anticipated rate of 250,000 gallons per day.

MCA ISSUES SAFETY GUIDE

The latest in a series of safety guides, SG-9, on the disposal of hazardous wastes, is now available from the Manufacturing Chemists' Association, Inc.

The pamphlet outlines recommended safe practices and procedures for disposal of flammable liquids, toxic and corrosive materials and other substances which may create an air or stream pollution problem.

The safety guide recommends that both a "hazard index" and a "disposal index" be established which would set out both the hazards of the waste material and the proper method for disposal.

The safety guide also urges that all waste disposal procedures be placed under the responsibility of one individual or department and that the plant safety organization act in a consultative capacity. Cooperation of the industrial hygienists or medical division also is required, the safety guide states.

The pamphlet describes several methods of disposal including open burning, burning in incinerators, disposal through sewers, and disposal by burying.

SG-9 is available from the Association at the headquarters office, 1825 Connecticut Ave., N. W., Washington 9, D. C. for 20 cents a copy.

RUSSIA HAS WATER POLLUTION PROBLEMS

According to Russian newspapers, there is considerable alarm at the pollution of Russia's 225,000 miles of rivers, which is killing fish and endangering public health.

The dumping of waste is reported to be damaging the fishing industry to the extent of about a quarter of a billion dollars a year. The northern Donetz River known as the "Ruhr of Russia," is said to be receiving wastes from sugar, chemical, and steel plants at the rate of over 275 million gallons per day.

Soviet scientists have called for action to stop industrial plants dumping waste products and for long-term planning to cover all branches of industry and public health organizations.

One newspaper stated that the trouble was due to acceptance of the philosophy that the dumping of waste products into rivers was necessary and unavoidable instead of meeting the problem by installing waste treatment facilities.

TESTING OF THE FREEPORT, TEXAS, SALINE WATER CONVERSION DEMONSTRATION PLANT UNDERWAY

Initial test operations of the 1 million gallons per day saline water conversion demonstration plant at Freeport, Texas, have started. A schedule of necessary preliminary tests have been programmed to check-out component parts of the plant. These operations began May 8, and fresh water from sea water was produced by this new process for the first time on May 12. Testing will continue for several weeks before the plant can be scheduled to begin continuous production of fresh water. An initial 15-hour sea water test-run at 75 percent of capacity has been successfully completed. An eight-day test at rated capacity is scheduled to begin soon.

The Stearns-Rogers Manufacturing Company of Denver, Colorado, and Houston, Texas, has been selected for the "Management and Operation" assignment for the Freeport, Texas, sea water conversion demonstration plant. The contract negotiated with Stearns-Rogers is a cost reimbursable plus fixed fee contract for \$241,249 per year. The product water from the plant will be sold in equal amounts to the City of Freeport and the Dow Chemical Company.

AIR POLLUTION

NEW YORK TELLS AUTO MANUFACTURERS TO INSTALL BLOWBY DEVICE

New York City recently warned eight automobile manufacturers to remove air-pollution sources from their new cars voluntarily or run the risk of being compelled to do so.

Arthur J. Benline, Commissioner of Air Pollution Control, told the auto makers they should install the recently developed crankcase blowby device as standard equipment on all new vehicles.

In letters to the eight manufacturers, Mr. Benline recalled that legislation was introduced at the 1961 session of the New York Legislature to make the blowby device mandatory on all new cars sold in New York State. While the legislation was not enacted, he said, it probably will be introduced again in 1962, "and there is every expectation that it will be received favorably."

The blowby device is a crankcase regulator that cuts the pollution from fumes blown past piston rings and the crankcase of vehicles.

In California the State Motor Vehicle Board has begun a program to put fume controls by law on all motor vehicles in the state.

AIR POLLUTION CONTROL ORDINANCE ADOPTED BY MONTEREY COUNTY

Monterey County, California's first ordinance dealing with the discharge of air contaminants was passed by the Board of Supervisors in January 1960. The ordinance was the result of two years of study and conferences by the Monterey County Air Pollution Control Advisory Committee. This committee had worked closely with representatives of the county, cities, and industry.

The ordinance prohibits the discharge of pollutants that are dark or darker in shade than No. 2 on the Ringleman Chart or equivalent opacity. It limits the emission of particulate matter to 0.4 grains per cubic foot (60° F. and 14.7 pounds per square inch absolute) and the emission of sulfur compounds to 0.2 percent by volume. It also includes general requirements regarding public nuisances. The Monterey County Health Officer has been designated as the control officer.

At present the ordinance applies only in the unincorporated areas of the county. Cities are expected to take the ordinance under consideration and determine if they should adopt similar ones in order to have a uniform county-wide approach.

Existing sources of emissions are exempt from complying with the ordinance for a period of five years.

NEW AIR POLLUTION STUDY STARTED

A major research project is now underway which should add valuable information to what is known about the health effects of air pollution. The study is a joint project with the Los Angeles County Air Pollution Control District, and the University of Southern California to observe the effects on laboratory animals--mice, guinea pigs, and rabbits--of breathing the same air breathed by people in Los Angeles County.

The contaminants of primary interest are those specifically associated with automobile exhaust -- hydrocarbons, oxidant, carbon monoxide, oxides of nitrogen, and certain particulates.

While the test animals breathe the air at special sites located at varying distances from the heavily traveled thoroughways, a control group of similar animals will be living in purified air from which contaminants have been removed. The study represents the largest research effort of its kind yet undertaken in the field of air pollution.

S. Smith Griswold, Director, Los Angeles County Air Pollution Control District will direct the establishment of 4 stations at which pollutants will be monitored and animals studied. The initial contract, at a cost of \$152,000 will cover the establishment, operation, and maintenance of these stations until June 15, 1961.

The University of Southern California will furnish and operate facilities for housing the exposed and control animal colonies, on the grounds of the University Medical School and at sites provided by the Los Angeles County Air Pollution Control District.

The work at the University of Southern California will be under the general direction of Dr. Leslie A. Chamber, Director of the Allen Hancock Foundation. Members of the faculty of the Medical School who will participate include: Dr. Paul Kotin, Assistant Professor of Pathology; Dr. Oscar J. Palchum, Assistant Professor of Medicine; Dr. John Mehl, Chairman of the Department of Biochemistry.

NUCLEAR ENERGY

EVALUATION OF ION EXCHANGE PROCESSES FOR DECONTAMINATION OF DRINKING WATER

The experiments with columns containing either greensand or a strongly acidic cation exchange resin in the sodium form have been completed at the University of California Sanitary Engineering Research Laboratory. Four types of water containing traces of yttrium-91 were passed through 2-foot beds of the exchange materials. The primary variable in determining the amount of yttrium leakage from the columns appeared to be pH. This is in harmony with previous findings of the project and with concurrent research on high-order decontamination supported by the National Institutes of Health, which indicated a dependence of the radiocolloidal fraction of this element on hydrogen ion concentration.

Prolonged operation of the columns at constant flow rates, extending to several hundred pore volumes, failed to indicate any tendency of the yttrium concentrations in the effluents to change with time. Increasing the flow rates from approximately 0.2 to approximately 2.0 gpm per square foot materially increased yttrium leakage. In all cases, greensand was more effective than resin in retaining yttrium.

Except in one case, in which the influent pH of the water was 6.1, yttrium leakage was too large to allow the treatment to be considered of practical value for decontamination purposes. Since the laws of ion exchange would lead one to expect rather complete removal of ionic yttrium under the conditions employed, interpretation of the results must rest on the assumption that a considerable fraction of the radioisotope is present in colloidal form. The possibilities of finding decontamination procedures for yttrium in this form are being studied.

SUBSURFACE DISPOSAL OF LIQUID RADIOACTIVE WASTE IN MICHIGAN BASIN STUDIED

A Geological Survey report summarizing the geology of the Michigan basin with respect to the disposal of liquid radioactive waste is now available for public reference.

The study was undertaken for the Division of Reactor Development, United States Atomic Energy Commission. The report is one of a series by the Geological Survey on sedimentary basins, with particular reference to possibilities for disposal of radioactive wastes. Data collected on different basins will aid in evaluating the practicability of subsurface disposal and storage of dangerous wastes produced during the reprocessing and purification of fuel elements from atomic power reactors.

The consensus is that studies of possible disposal areas and the selection of disposal sites should be made well in advance of the time when any substantial amount of the Nation's electrical power may be generated by atomic power reactors. The reprocessing of fuel elements eventually may yield many thousands of gallons of radioactive liquid waste per day.

"Geology of the Michigan basin with reference to subsurface disposal of radioactive wastes," by Wallace deWitt, Jr., has been issued as Trace Elements Investigations Report 771. Manuscript copies may be inspected at various places including the Geological Survey Libraries, 1033 General Services Administration Building, Washington, D. C.

NEW LAND BURIAL SITE PLANNED

The first commercial land burial site in the U. S. for solid radioactive wastes is planned for 80 acres of state-owned land in the Amargosa Desert near Beatty, Nevada, by the Nuclear Engineering Company of Pleasant, California. The starting date is set for July 1, 1961, if all contract and licensing arrangements between the Nuclear Engineering Company and the State and AEC are completed by that time.

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BACK ISSUES OF THE DIVISION JOURNALS

----are in such demand that staff headquarters finds itself without a complete record set. Such a set is being assembled for the ASCE Publications Record Room at the United Engineering Center, soon to be dedicated in New York City. The record set of Proceedings reprints is complete; but the Journal file lacks a few issues, as follows:

	<u>1956</u>	<u>1957</u>
Air Transport	May	
City Planning	February, May	
Engineering Mechanics		April
Highway	May	

19561957

Hydraulics	April, June, August
Irrigation and Drainage	February
Pipeline	March
Power.	February, April, June..... February
Soil Mechanics and Foundations ...	January, October
Structural.	March, May
Surveying and Mapping	March
Waterways and Harbors.	April, May, September

Members who can spare any of the foregoing copies will be doing a service to the Society by mailing them to Harold T. Larsen, ASCE, Room 1607, 33 West 39th Street, New York 18, New York.

TO ASCE MEMBERS OF CHI EPSILON

Chi Epsilon Fraternity, national civil engineering honor society, has officially offered to supply the funds necessary to furnish a formal Conference Room at the United Engineering Center. This room will be on the ASCE executive floor, will be named "The Chi Epsilon Room," and will be available for conference and committee meetings.

Pledges are not expected, but single voluntary gifts, from members and friends of the Fraternity are earnestly solicited. An attractive Commemoration Book has been planned in which donors of \$100 or more (singly or in groups) may inscribe the name of a revered person.

On request, the national chairman, Samuel Kramer (8701 Shore Road, Brooklyn 9, New York) will be glad to mail a descriptive brochure. Your gift is tax deductible if you make your check out to "ASCE CHI EPSILON ROOM FUND" and mail it to Mr. Donald D. King, ASCE, 33 West 39th Street, New York 18, N. Y. Your gift will be automatically credited to the quota of your initiating Chapter. The national goal is \$10,000.

CUMULATIVE INDEX TO ASCE PUBLICATIONS

A three-part index to Proceedings, Transactions, and CIVIL ENGINEERING is now available. This 816-page, 6 in. by 9 in., blue cloth bound book contains a subject and name index for CIVIL ENGINEERING that covers the magazine since its inception in 1930 through 1959. For Proceedings, the coverage is from 1950 through 1959, a period in which most papers were not included in Transactions. The 1935 through 1959 Transactions are indexed to provide a valuable source of reference to "modern" technical civil engineering literature.

The list price for this volume is \$20.00. Members of ASCE and public and school libraries are entitled to a 50% discount and will, therefore, pay \$10.00 per volume.

Order your copy of this INDEX by use of the coupon herewith.

-----CUT HERE-----

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CUM IND

SYMPOSIUM ON STILLING BASINS AND ENERGY DISSIPATORS

In answer to a need to make available in one volume a series of papers on Stilling Basins and Energy Dissipators (from the Journal of the Hydraulics Division), Proceedings Symposium No. 5 has been prepared.

This 312 page book contains eight informative papers and all of their discussion. The paperbound volume is available at a price of \$6.00 with the usual 50% discount to Society members and public and school libraries.

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Please send _____ copy(s) of the Symposium on Stilling Basins and Energy Dissipators. I am _____ I am not _____ a member of ASCE. The amount enclosed is \$ _____.

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1. The first step in the process of the development of a new product is the identification of a market need. This is often done through market research, which can be conducted in a variety of ways, including surveys, focus groups, and interviews.

2. Once a market need has been identified, the next step is to develop a concept for the product. This involves creating a detailed description of the product, including its features, benefits, and target market.

3. The third step is to conduct a feasibility study. This involves assessing the technical, financial, and market viability of the product concept. This is often done through a series of tests and experiments.

4. The fourth step is to develop a business plan. This involves creating a detailed financial and marketing plan for the product. This is often done through a series of calculations and projections.

5. The fifth step is to secure funding. This involves raising the capital needed to develop and launch the product. This is often done through a combination of sources, including venture capital, angel investors, and bank loans.

6. The sixth step is to develop a prototype. This involves creating a physical model of the product that can be used to test and refine the design. This is often done through a series of iterations and improvements.

7. The seventh step is to conduct a pilot test. This involves launching the product on a small scale to test its market acceptance. This is often done through a limited release or a beta test.

8. The eighth step is to launch the product. This involves releasing the product into the market and promoting it through a variety of marketing channels. This is often done through a combination of advertising, public relations, and sales efforts.

9. The ninth step is to monitor the product's performance. This involves tracking sales, customer feedback, and market trends. This is often done through a series of reports and analyses.

10. The tenth step is to refine the product. This involves making improvements to the product based on customer feedback and market trends. This is often done through a series of updates and revisions.

11. The eleventh step is to expand the product. This involves launching the product in new markets or developing new product lines. This is often done through a series of strategic decisions and investments.

12. The twelfth step is to maintain the product. This involves ongoing marketing and sales efforts to keep the product competitive in the market. This is often done through a series of continuous efforts and adjustments.

13. The thirteenth step is to evaluate the product's success. This involves assessing the overall performance of the product and determining whether it has achieved its goals. This is often done through a series of final reports and analyses.

14. The fourteenth step is to discontinue the product. This involves removing the product from the market and ceasing all marketing and sales efforts. This is often done through a series of strategic decisions and announcements.

15. The fifteenth step is to learn from the experience. This involves reflecting on the product's development and launch process and identifying lessons learned. This is often done through a series of debriefings and discussions.

16. The sixteenth step is to apply the lessons learned to future products. This involves using the insights gained from the product's development and launch to inform the development of future products. This is often done through a series of strategic decisions and adjustments.

